



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EDISON, NEW JERSEY 08837

February 1, 1983

51860

Captain George F. Ireland
COTP-Providence, R.I.
John O. Pastore Federal Building
Providence, RI 02903

Dear Captain Ireland:

Attached is Interim Report #2 on the Movement of PCB's in New Bedford Harbor which describes our latest round of studies conducted in January to investigate the movement of PCB's in New Bedford Harbor. This report emphasizes the logistics and details associated with the actual conduct of the study effort, including the methodology and techniques used in the collection of the oceanographic data.

Most of the physical data has been received and is presently being reduced for marriage with the results of the PCB analyses which are forthcoming. Dick Jadamec (USCG R&D Laboratory) has indicated that all the analytical work should be completed and supplied to us by February 10th. This will allow us to perform specific statistical tests to correlate the PCB levels observed with certain physical parameters. Once these procedures have been completed, we can then interpret the data and postulate transport mechanisms for the Upper Harbor area, as well as evaluating the representativeness of the data collected during the September study.

Barring any unforeseen difficulties, we should be in good shape to present our preliminary findings at another meeting of the Technical Review Panel on February 17th at EPA Regional Laboratory in Lexington, MA. As previous, we anticipate that this meeting will commence at 1000hours(EST). The comments from the Technical Review Panel will be most helpful in preparing for the RRT meeting.

We expect that a final draft will ready for circulation for comment during the second week in March with a final report completed shortly after the receipt of the comments from the reviewers.

Attachment

Sincerely yours,

Royal E. Nadeau

cc. Ken E. Biglane	EPA Headquarters, Washington, DC.	(w/att)
✓Rick Stanford	EPA Headquarters, Washington, DC.	"
Gerard Sotolongo	EPA Region I, Boston, MA.	"
Ed Conley	EPA Region I, Lexington, MA.	"
Dr. Tudor Davies	EPA Narragansett Laboratory	"
Captain B. Eldridge	USCG-District Hqts, Boston, MA.	"
Richard Jadamec	USCG-R&D, Groton, CT	"

AEROVOX PCB DISPOSAL SITE
ACUSHNET RIVER AND NEW BEDFORD HARBOR, MA

PCB MASS TRANSPORT STUDY

by the
ENVIRONMENTAL RESPONSE TEAM
Edison, N.J.



Second Interim Report
January 1983

sediments settled out of suspension in about 30 minutes. The residual concentrations of PCBs remaining adsorbed to suspended particulates after two hours of testing were positively correlated to the original PCB concentration of Acushnet River sediments. An oil phase was also released during turbulent mixing studies, indicating that PCB co-solubility in oil provides another mechanism for PCBs to enter the water column. PCBs were also found to leach into overlying even under quiescent water conditions. The PCB concentration in the water column was also directly related to sediment concentration.

Field studies revealed some interesting phenomena that indicate the difficulties encountered when characterizing an estuary on the basis of only one complete tidal cycle, conducted under clear weather conditions. A brief reversal of tide flow was apparent in both the flood and the ebb tide. Higher concentrations of particulate PCBs occurred in the flood tide when compared to the ebb tide. Low level contamination of fresh waters feeding the Acushnet River was discovered.

The Technical Task Group which met in December 1982 indicated that some observations made during the September study may be anomalous. On this basis the following recommendations were made:

- A. The mixing patterns of this water mass needed more study.
- B. A mass transport study balance for PCB's in this water mass was needed.
- C. New studies should attempt to encompass a major rainfall event.
- D. New studies should be used to determine if the September efforts are representative of transport mechanisms in effect in New Bedford Harbor.

ADDENDUM STUDIES

To accomodate the recommendations of the December Task Group, a more comprehensive study on the upper reaches of the Acushnet River and New Bedford Harbor was planned. On January 10-12, 1983 a joint USCG COTP-PROV and EPA (ERT) effort was conducted to continuously monitor the water mass passing through the Coggeshall bridge for three complete tidal cycles (39 hours). Examining three consecutive tidal cycles minimizes the potential for anomalies in one tidal cycle to bias overall study results. Comparisons between the January and September studies may also be made to clarify the September results.

A major objective of the January studies was to provide a more detailed investigation of the mixing patterns and characteristics of the water mass passing beneath the Coggeshall Bridge. This objective was achieved through the design of a more intensive sampling scheme which partitioned the cross-section of the water mass below the bridge into a 3 x 3 grid. Combining the data from the grid sections provided a better characterization of the whole water mass than the September study provided.

The weather was perfect to meet study objectives, with a significant rainfall event occurring during the first flood tide studied, between 3:00am and 6:30am on January 11. The storm was accompanied by strong southeasterly winds, resulting in an unusually high early morning tide. Normal sampling runs were conducted by the survey team despite the heavy rains and two to three foot swells.

PERSONNEL/OPERATIONS

Two crews, comprised of five to seven members, worked alternating six hour work shifts to provide continuous monitoring of the water mass. A list of personnel involved in field operation is included in Table 1. Shifts normally overlapped from 15 to 30 minutes to assure smooth operations. At a minimum, a four-man boat crew manned the 21-foot, inboard/outboard aluminum boat provided by the USCG. The crew consisted of two Coast Guard members, an ERT representative and a technician from ENDECO (an oceanographic consulting firm contracted by ERT). All boat crew members wore "Mustang" suits for protection from the elements and to provide flotation in case of mishap.

The command post, a Winnebago stationed in a parking lot west of the bridge, was occupied by one or more personnel responsible for maintaining data logs and continuous radio communication with the boat crew. The CP also provided an area for the transfer of information and debriefing as crews changed shifts.

USCG personnel out of Groton, CN provided support in their mobile laboratory, located adjacent to the command post. While water samples and physical characteristics of the harbor were being measured from the boat, the lab crew filtered previously collected samples and began the extractions necessary to prepare samples for PCB analysis.

PARAMETERS MEASURED

Tide Staff: A fiberglass surveying range-pole, scaled to tenths of a foot, was erected beneath the Coggeshall Bridge to record fluctuations in water level beneath the bridge due to tidal action. Readings were obtained at least every 30 minutes. Staff readings have been plotted against time in Figure 1.

Depth Profile: Direct depth readings were taken from the bridge railing using a weighted rope marked off in one-foot increments. Measurements were taken every three feet between the abutments of the Coggeshall Bridge. The profile was completed within a 30 minute period during the afternoon flood tide on January 12.

Salinity, Conductivity, and Temperature: Salinity, conductivity, and temperature measurements were taken using a Yellow Spring Instrument Co. (YSI) model 33 S-C-T meter. The operating principle of this instrument is based on the ability of ionized substances in the water column (in this case primarily dissolved salt) to carry an electric current between electrodes in the instrument's probe. Since electrolytic conduc-

tivity is temperature dependent, an electrical thermometer having a small thermistor sensing element was also incorporated into the instrument because of its rapid response. This instrument is sensitive to the nearest 10 umhos/cm for conductivity, the nearest part per thousand for salinity and 1°C for temperature.

Dissolved Oxygen: Oxygen concentrations were measured with a YSI model 54 oxygen meter with a battery powered agitator adaptor. The agitator keeps a fresh supply of water moving across the oxygen-sensitive membrane electrodes in the D.O. probe to avoid localized dissolved oxygen depletion around the membrane. The 50-foot cables for the D.O. meter and the S-C-T meter were taped together and lowered as a single unit to achieve simultaneous readings.

Flow Rate and Direction: Two technicians from Endeco, Inc., an oceanographic consulting firm, were contracted by ERT to provide measurements of flow and transmissivity. A stationary Endeco type 174 digital recording current meter system was tethered to a steel cable centered on the south side of the Coggeshall Bridge. The instrument was lowered to a stationary depth five-feet off the bottom of the channel beneath the bridge. Every two-minutes the meter recorded flow rate, flow direction, temperature, conductivity, and salinity. Recordings were made on a magnetic tape contained within the submerged instrument. The deviation of the meter is +/- 3 percent for flow rate and +/- 7.2° for direction when flow rate is greater than .05 knots (2.57 cm/sec). A different flow meter was used to obtain flow readings at each discrete sampling location and depth. This meter provided direct readings of flow and direction to an instrument panel kept on the boat.

Light Transmission: A Sea Tech, Inc. Transmissometer S.N. 102 was used to determine differences in light transmission at all sample locations and depths. The instrument directs a monochromatic light beam through the water column toward a detector over a 25 cm pathlength. Dissolved or particulate matter entrained in the water will scatter or absorb a portion of the light transmitted. The remaining light reaching the detector is converted into electrical current which is read in volts on an onboard instrument panel. After laboratory calibration of the instrument, the voltage reading can be converted to the percent of light transmitted or absorbed. Generally speaking, the higher the transmission of light, the higher the water quality. This particular model has a +/- 0.5 percent accuracy.

Suspended Material: A plankton net was used to collect samples of suspended materials. The 143 um mesh, 12 cm diameter net was attached to the center cable on the south side of the Coggeshall Bridge at a depth of five feet. Samples were collected for up to 2 hours during the high flow periods of both the flood and the ebb tide. The sides of the net were rinsed down into a collection vessel with distilled water. These samples will be extracted and analyzed for PCBs. By knowing the flow rate and the surface area sampled by the plankton net, total suspended particulate loading can be determined for particles greater than 143 um.

SAMPLING PROCEDURES

The timing of water sampling and measurement of physical characteristics is shown graphically in Figure 1. Sampling efforts were designed to characterize the highest flow periods of both the ebb and the flood tide, for each of the three tidal cycles studied. To achieve this end, samples and measurements were collected at all stations and depths during high flow periods. Additional samples were collected only at station B.2 (center of the bridge) during slack water periods.

The Coggeshall Street Bridge was used to delineate three sampling stations (Figure 2). Each station was marked by a steel-cable, suspended vertically from the north side of the bridge and anchored with 100 lb. weights. The cables were placed at equal distances across the channel, dividing it into thirds. The cables served as guidelines for lowering the instruments, probes and samplers to prevent these devices from being carried off by the swift current under the bridge. The cables were delineated as station B.1, B.2, B.3 for the eastern, center, and westernmost cables, respectively. An additional cable was centered in the channel on the south-side of the bridge. This cable was used to tether the continuous flow meter and the plankton net.

To provide for a synoptic survey of the estuary, two more sampling stations were located 1.4 miles north and 0.5 miles south of the Coggeshall Bridge. A standard navigational aid, Nun Buoy #4, marked the southern sampling location (S) and a temporary buoy marker was used to identify the north sampling station (N).

To adequately characterize the entire water column at the various sampling stations, each station was divided by depth into a surface third, a middle third, and a bottom third. At the appropriate times designated in Figure 1, the following sampling and physical measurement scheme was conducted at stations B.1 (Bridge-East) and B.3 (Bridge-West).

- (1) Physical measurements, including all of the parameters mentioned above, were taken at three discrete depths to characterize the surface, middle, and bottom third of the water column.
- (2) Water samples were taken with a brass Kemmerer sampler. Three, one-liter glass jars with teflon-lined caps were filled with water from the surface, middle, and bottom third of the water column. These samples were composited in the mobile laboratory. In addition to the composite sample, a discrete water sample was taken from the bottom third of the water column.

The following procedures were followed at stations N and S:

- (1) Physical parameters were measured at discrete

locations in the surface, middle, and bottom third of the water column.

- (2) Two or three, one-liter water samples were collected to represent the various sections of the water column.

The more intensive sampling which occurred at the center bridge station, B.2, can be described as follows:

- (1) Physical parameters were measured as described for the above stations.
- (2) Two, one-liter water samples were collected from three discrete depths within the surface, middle, and bottom third of the water column. Each set of two samples from a particular layer in the water column was composited in the mobile laboratory, resulting three discrete samples from this location.

LABORATORY PROCEDURES

USCG research and development personnel conducted the following activities in their mobile laboratory to prepare samples for analysis of total suspended solids (TSS) and polychlorinated biphenyls (PCBs).

The two, one-liter discrete samples and the composited samples were individually vacuum-filtered through 0.45 μ x 47mm Milipore® glass fiber filter pads, which were dried and tared prior to on-site response. Between one and two liters of the filtered water was then placed into a hexane-rinsed bottle. Any residual particulate materials in the original sample bottles was washed onto the filter pad with HPLC grade distilled water. The filter pad was then placed into a petri dish filled with silica gel and taped shut. Approximately two-thirds of all the water samples taken were filtered by the above manor in the mobile laboratory. In most cases, one-liter of filtered water was extracted with four, 20 ml portions of pesticide grade hexane. The hexane extracts were combined into hexane-rinsed glass vials for storage. Fifty percent of the filtered water samples were extracted in the mobile laboratory. Mystic River water and HPLC grade distilled water was used for blanks.

STATUS

On-scene operations began at 1200 hours on January 10, 1983 and were completed by 2000 hours on January 12, 1983. Data is currently being compiled and evaluated by ERT. Future reviews, comments, and actions by responsible Federal, State, and local agencies are expected.

TABLE 1: PERSONNEL

U.S. COAST GUARD

Marine Safety Office, Providence, R.I.

Ted Harrington	Lieutenant Junior Grade
Chris Oelschlegel	Lieutenant Junior Grade
John O'Connor	Quartermaster, First Class
Tom Marton	Machine Technician, Second Class
Christopher Blake	Port Securityman, Second Class
Russel Boyton	Machine Technician, Second Class
David Cate	Boatswain, Third Class

U.S.C.G. Research and Development Center, Groton, CN

Bob Hildebrand	Ph. D
Dick Jadamac	Chemist
Mike Sweetman	Marine Science Technician Chief

U.S. EPA-ERT

Royal Nadeau	Ph. D
George Prince	

WESTON, INC.

Phil Campagna
Charles Atwood

ENDECO, INC.

Nelson Adams
Edward Blainard III

FIGURE 1: TIDAL CYCLE - SAMPLING PATTERN

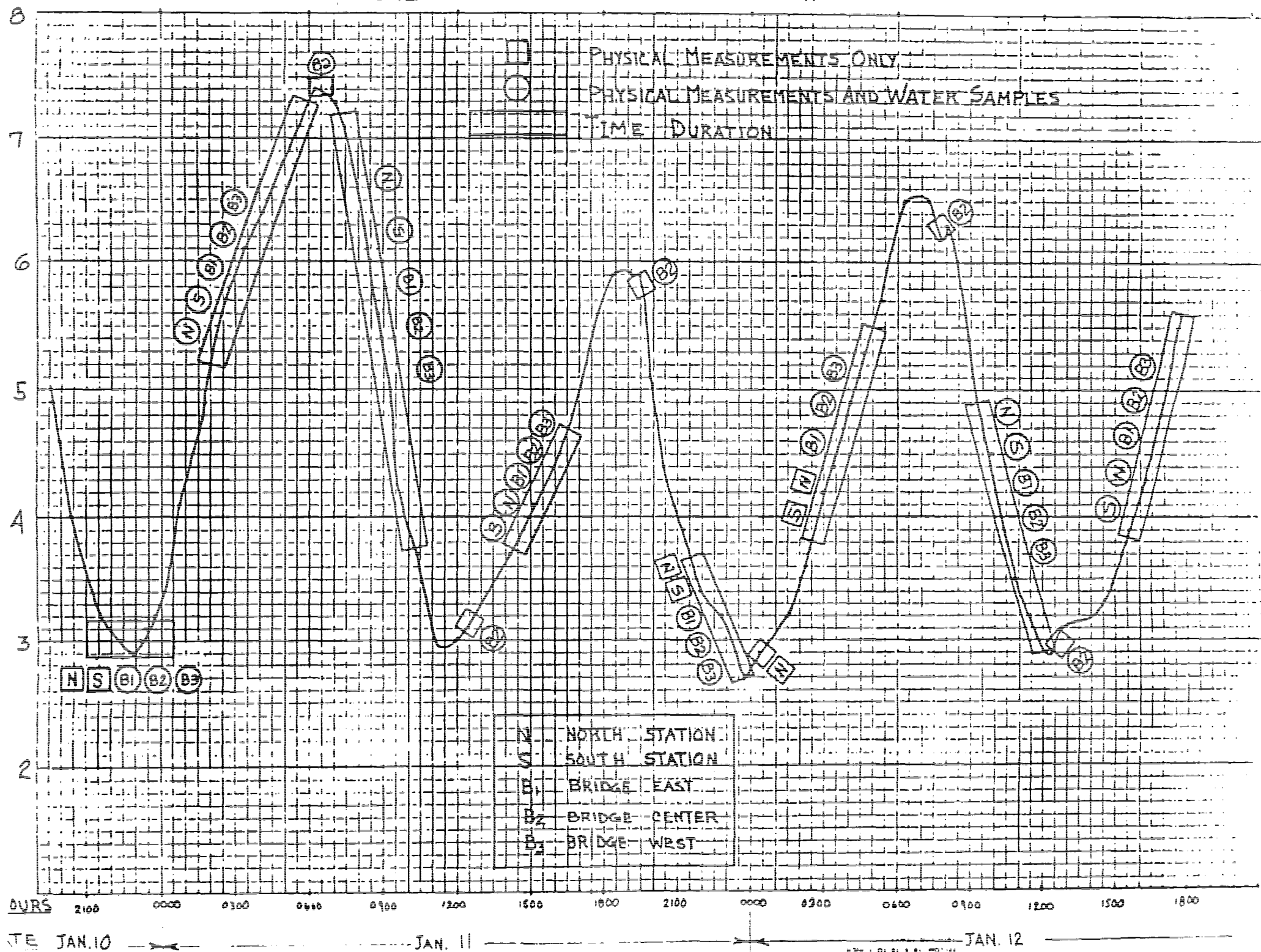
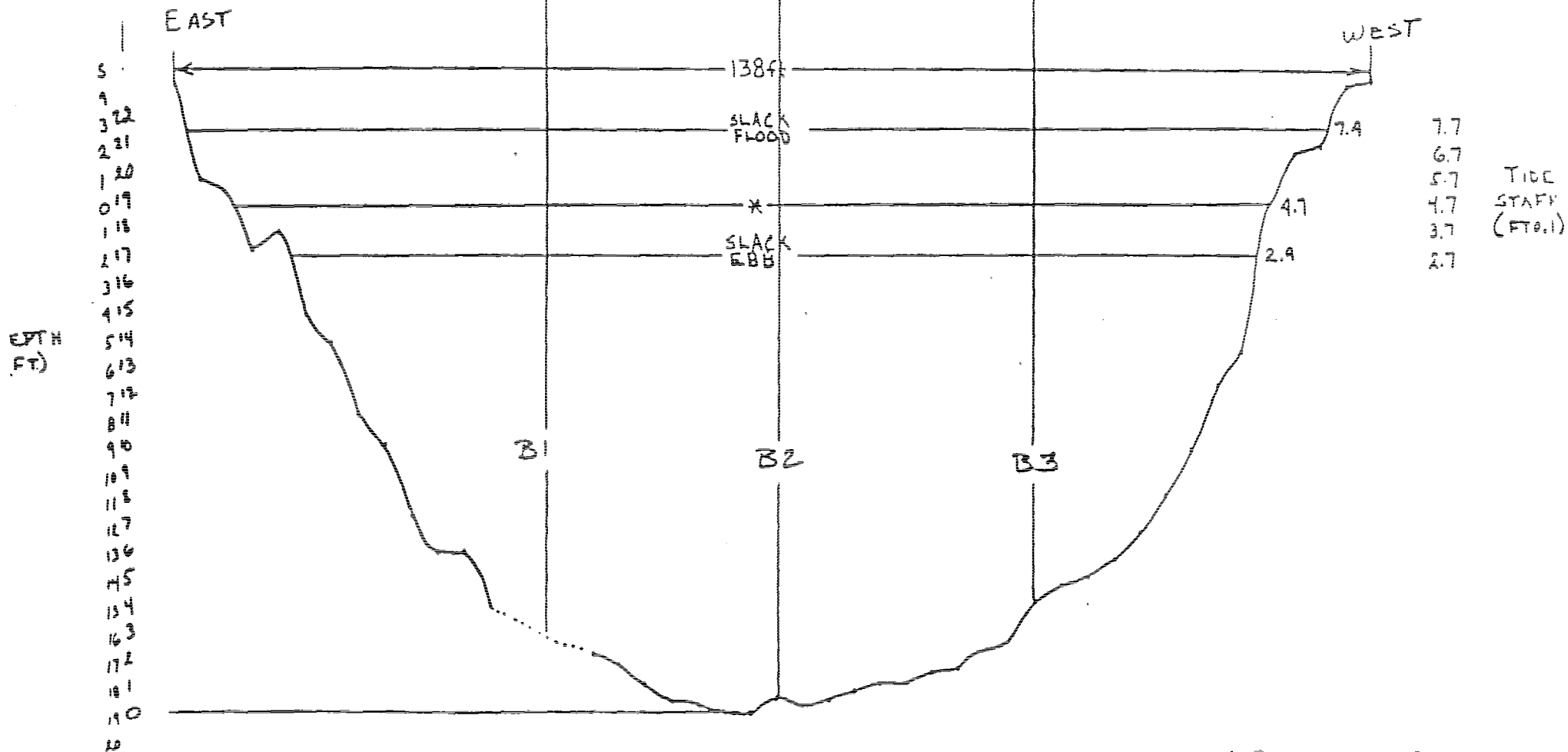


FIGURE 2: CROSS SECTIONAL AREA

ACUSHNET RIVER

COGGASHALL STREET BRIDGE

12 JANUARY 1983
1643 HRS.



* REPRESENTS THE TIDE
HEIGHT AT TIME OF
BATHYMETRIC MEASUREMENTS